THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

082 ELECTRICAL ENGINEERING SCIENCE

(For Both School and Private candidates)

Time: 3 Hours **Year: 2022**

Instructions

1. This paper consists of section **A**, **B** and **C** with total of f**ourteen (14)** questions.
2. Answer **all** questions in section **A** and **B**, and **three (3)** questions from section **C.**
3. Section **A** carries **ten (10)** marks , section **B** and **C** carry **forty five (45)** marks each.
4. Cellular phones, and any unauthorized materials are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet (s).

SECTION A (10 marks)

Answer **all** questions in the section

1. Choose the correct answer for each item (i) to (x) and write its letter in the answer booklet provided.

i) Which quantity is measured in farad as the nature and behaviors of electrical quantities are considered?

A. Reactance
B. Inductance
C. Impedance
D. Capacitance
E. Resistance.

ii) A Transformer having 1000 primary turns is connected to 250 V A.C supply. If secondary voltage is 400 V, what is the number of secondary turns?

A. 1700
B. 1800
C. 1600
D. 1650
E. 1550

iii) How are the transformer laminations insulated from each other?

A. By mica strip
B. By thin coat of vanish
C. By glass
D. By P.V.C
E. By rubber insulation

iv) Which of the following devices apply magnetic effect to operate?

A. Fuse
B. Cell

C. Bell

D. Toaster

E. Cooker.

v) Which one can cause accidents in an electrical workshop?

A. Wearing goggles

B. Sweeping the floor

C. Large working space

D. Wearing loose sleeve shirts

E. Using wooden chairs.

vi) Which statement is true about the purpose of the commutator in D.C. machine?

A. It takes away generated voltage.

B. It converts output current to voltage.

C. It converts D.C voltage to A.C voltage.

D. It rectifies A.C voltage to D.C voltage

E. It converts AC current to D.C current.

vii) Where is it appropriate to use wattmeter for measuring purposes?

A. In measuring apparent power.

B. In measuring true power.

C. In measuring reactive power

D. In measuring average power.

E. In measuring estimated power.

viii) What will happen in an induction motor if the air gap is increased?

A. Bearing friction will increase.

B. Windage losses will be more.

C. Copper losses will be reduced.

D. The power factor will be low.

E. The power input will be more.

ix) Which of the following are the main effects of an electric current?

A. Magnetic, Electromagnetic and Electricity.
B. Chemical, Magnetic and boiling
C. Heating, repelling and attracting
D. Magnetic, Heating and Electric
E. Heating, Chemical and Magnetic.

x) Why are electrical appliances connected in parallel?

A. Parallel circuit is simple in connection and economical.
B. Appliances drew high current and power.
C. Appliances drew high current and less resistance.
D. Appliances in parallel reduce power loss and cost.
E. The operation of appliances is independent of each other.

SECTION B (45 marks)

Answer **all** questions from this section

2. (a) Draw an electrical symbol of an air cored transformer.

   (b) Calculate the efficiency of a transformer for a single phase transformer with an input and output power of 2 kW and 1.9 kW respectively.

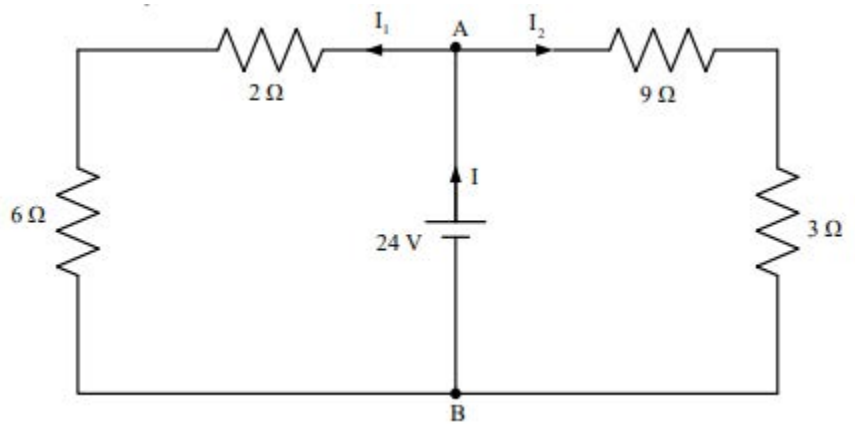
3. A moving coil instrument gives full-scale deflection with 15 mA and has a resistance of 5 Ω. Calculate the resistance required to enable the instrument to read up to:

   (a) 1 A in parallel connection.

   (b) 10 V in series connection.

4. Calculate the supply voltage necessary for charging a battery of 110 cells at 30 A at the beginning and at the end of the charge. Each cell possesses a p.d of 2.1 volts at the beginning and 2 volts at the end of charge. Allow 0.06 Ω for the resistance of the connecting leads.

5. Study the circuit shown in the following circuit and answer the questions that follow.



(a) Find the value of I_1 and I_2

(b) Calculate the total current I.

6. A lamp rated 230 V gives an illumination of 6000 lux and it takes 1.5 A from the mains. Calculate:
   (a) Efficiency of the lamp.
   (b) Mean spherical candle power.
7. A 4 poles, long shunt compound generator supplies 100 A at a terminal voltage of 500 V. If the armature resistance is 0.02 Ω, series field resistance is 0.04 Ω, shunt field is 100 Ω and the brush drop is 2 V, find the generated E.M.F
8. Find the efficiency of a water heater which heats 140 liters of water with a specific heat capacity of 4180J/kg/ºC from 10ºC to 60ºC in 3 hours, given that, the water is heated by a 3 kW heater element.
9. Given the equation of an alternating current flowing through a certain circuit which is given by, $i = 50\ sin\ 628\ t$, Determine:
   (a) the maximum value of current;
   (b) the r.m.s value of current,
   (c) the frequency of the current
10. A current of 6 A flows through a coil of 400 turns which is wound over a ring

made from a non-magnetic material. The ring has a circumference of 500 mm and a uniform cross-sectional area of 0.5 cm^2 . If the permeability of free space is $4\pi x10^{-7}$ and relative permeability of non-magnetic material is 10,

calculate: (a) the magnetic field density;

(b) the flux density,

(c) the total flux.

SECTION C (45 marks)

Answer any **three (3)** questions from this section

11. (a) Briefly explain how each of the three major losses in A.C generator takes place

(b) Calculate the line current when three similar coil each having a resistance and inductance of 20 Ω and 0.05 H respectively, are connected in star to a three phase 50 Hz supply with 400 V between lines.

12. A coil of resistance 100 Ω and inductance 100 μH is connected in series with a 100 pF capacitor. The circuit is connected to a 10 V variable frequency supply. Calculate:

(a) The resonant frequency.

(b) The current at resonance

(c) The voltage across L and C at resonance then, comment on the voltage obtained.

(d) Q factor of a circuit.

13. An inductance (L) 0.0637 H is connected in parallel with 30 Ω resistor. The combination is supplied by 200 V of 60 Hz

(a) Draw the circuit diagram including the parameters provided.

(b) Calculate the following parameters:

(i) Current in each branch.

(ii) Impedance of the circuit.

(iii) Phase angle of the circuit.

(c) What will happen to the circuit characteristics if R is removed?

14. (a) What is the importance of insulation part of the cable?

(b) Each conductor of 3-core copper cable, 178 meters long has a cross sectional area of 15 mm^2 . The cable supplies power to a 413-V, 3 phase motor of 22 kW output which works at a full load at 0.72 p.f lagging with an efficiency of 87 per cent. Calculate:

(i) The voltage required at the supply of the cable

(ii) The power loss in the cable.